

III. LONG RANGE PLAN

LONGRANGE IMPLEMENTATION PLAN
SAN JUAN RIVER RECOVERY IMPLEMENTATION PLAN

7 FEBRUARY 1995

PREPARED BY:

SAN JUAN RIVER RECOVERY IMPLEMENTATION PROGRAM
BIOLOGY COMMITTEE

1.0 INTRODUCTION

1.1 AUTHORITY

The San Juan Recovery Implementation Program has as its two major bases; 1) obligation of all federal agencies operating in the basin to fulfill the requirements of the Endangered Species Act and other statutes, and 2) the responsibilities and authorities of the states and tribal governments for the stewardship and management of natural resources of the Basin.

The San Juan Recovery Implementation Program (Program) became operational in October 1992, executed by the signing of a Cooperative Agreement by the Department of the Interior, the States of Colorado and New Mexico, and the Ute Mountain Ute, the Southern Ute, and the Jicarilla Apache tribes. The Program incorporated as its core the Reasonable and Prudent Alternative included in the Biological Opinion for the proposed Animas-LaPlata Project and the commitment of involved agencies to a Seven Year Research effort to document the response of the native fish community to flows released from Navajo Dam to mimic the natural hydrograph of the San Juan River. The Navajo Indian Irrigation Project Biological Opinion added to the requirements and incorporated specific information needs for that project into the overall investigative effort. Subsequently, a Biological Opinion was issued to the U.S. Bureau of Land Management regarding oil and gas development in the Basin. This Biological Opinion included participation of USBLM in the Seven Year Research Plan. Other entities may enter the Program as a result of Endangered Species Act Section 7 consultation or as provided in the San Juan River Recovery Implementation Program.

Section 5.3.1 of the San Juan River Recovery Implementation Program document sets forth the requirement of the Biology Committee to formulate a Long Range Implementation Plan (LRP) to establish milestones to be utilized in analyzing the progress of the Program.

1.2 PURPOSE

The purpose of the Long Range Plan is to provide the infrastructure necessary to guide and document the delineation and accomplishment of recovery steps to achieve the goals identified for the San Juan River Basin Recovery Implementation Program. This Long Range Plan provides milestones for marking progress in achieving the goal of recovery of the endangered fish species. As set forth in the Program document, the goals of the Program are two-fold:

1. To conserve populations of Colorado squawfish and razorback sucker in the Basin consistent with the recovery goals established under the Endangered Species Act, 16 U.S.C. 1531 et seq.
2. To proceed with water development in the Basin in compliance with

federal and state laws, interstate compacts, Supreme Court decrees, and federal trust responsibilities to the Southern Utes, Ute Mountain Utes, Jicarilla Apaches, and the Navajos.

The time frame for the achievement of the Program's goals is 15 years; hence, this Long Range Plan (LRP) is directed toward the realization of discernable and appreciable positive biological responses of the endangered fish species and their habitats to management of water and other resources in the Basin within that time frame. Recovery of the two endangered species (Colorado squawfish and razorback sucker) is not considered viable without fully understanding and managing the native fish community of which they are a component. Thus, this Long Range Plan addresses the aquatic components and terrestrial linkages to the aquatic system of the Basin that may affect the native fish community.

For the purposes of the San Juan River Long Range Plan, management of the native fish community is defined as those activities which are necessary to provide for the biotic and abiotic needs essential to the recovery of the endangered species.

Within the 15-year planning horizon encompassed by the Program, this Plan will provide for the formulation of annual work plans for the satisfaction of identified information needs, the timely evaluation of the success of actions implemented to protect and recover the endangered fish species of the Basin, and the short term, intermediate, and ultimate actions necessary to attain recovery and allow for compatible development of the Basin's resources. The integration and evaluation of research results and, as appropriate and possible, adaptive management actions, will occur annually to provide the foundation upon which planning, research, and recovery action initiatives can be tested. The Biology Committee shall report to the Coordination Committee annually as to these matters.

2.0. LONG RANGE PLAN

It is recognized that the Endangered Species Act imposes no legal requirement to protect the native fish community apart from the endangered fish, and that there is no legal requirement within this RIP to curtail water development on account of its impact on the native fish community apart from the endangered fish species. However, recovery of the endangered species requires understanding the functional relationships of the biotic and abiotic components of the San Juan River and how they influence its native fish community. Narrowly focusing on only the two endangered species will omit important components on which the recovery of those species may depend. Therefore, a broadly based fish community approach is essential to achieving the goals of the San Juan River Recovery Implementation Program. In addition, the relative achievement of these goals will be the criteria upon which success of the Program as a whole will be judged and evaluated.

2.1. BACKGROUND

The native fish community of the San Juan River evolved in a system characterized by dramatic physical environmental changes. Flow varied from almost non-existent to devastating floods. Seasonal and annual environmental changes wrought by widely different flows were not predictable, but over time such variations were certain to occur. Such extremes in abiotic conditions presented aquatic organisms with environmental conditions that changed frequently in availability, quality, and extent. Within the naturally variable system, species evolved strategies to utilize the differentially available habitats and avoid competition for such. The selective pressures of harsh environments contributed to low species richness and diversity of the San Juan River. Although few in number, most native fish species are long-lived. Different life stages (i.e., larva, juvenile, sub-adult, and adult) differentially utilize available resources and thus function as distinct ecological species. Despite a level of niche segregation, the ecological species are interdependent. A superficially simple system belies a complex one of many subtle biotic and abiotic interactions and dependencies.

The imperilment of the native fish community and extirpation of several native species were caused by a variety of human-induced biotic and abiotic modifications of the San Juan River ecosystem. Only four of the verified eight native fish species in the San Juan River system remain comparatively common in the drainage. Dams and diversion structures fragmented ranges, disrupted natural thermal and flow regimes, altered sediment transport dynamics, and diminished availability of seasonally required habitats; agriculture, industry, mineral extraction, and urban development diminished water quantity and quality; artificial channel structuring eliminated important habitats; establishment and encroachment of non-native riparian plant species reduced the naturally varying river channel; watershed management practices, exacerbated by natural climatic change, elevated sediment loading of the river; and introduction and establishment of over 20 non-native fish species and management of non-native sports fishes (including native fish eradication) imposed additional competitive and predaceous pressures. The strategies native fishes evolved to survive in a naturally variable and harsh environment ill-prepared them for persistence in an artificial and human-modified system.

Successful accomplishment of the Long Range Plan is dependent upon acquiring and utilizing information from a variety of disciplines. Considerable effort must be expended to characterize the biological attributes of individual fish species in the San Juan River, intra- and interspecific interactions, relation of various abiotic manipulations to the structure and dynamics of fish communities, and factors which may limit any species or native aquatic communities.

3.0. GOALS

The major focus of the LRP is recovery of the endangered fish species. The goals as presented below form the general structure of the community approach of which the endangered species are a part.

3.1. MAINTENANCE AND ENHANCEMENT OF THE NATIVE FISH COMMUNITY OF THE SAN JUAN RIVER.

The native fish community of the San Juan River basin was composed of at least eight species and perhaps ten. Among the verified native fishes, only speckled dace, flannelmouth sucker, and bluehead sucker remain comparatively common and widespread. Mottled sculpin is common in Colorado tributaries and in New Mexico is found mainly in the San Juan drainage above Farmington. Colorado cutthroat trout is eliminated from almost all areas of former occupancy. The range of roundtail chub is fragmented and it is generally rare where present. Colorado squawfish is found in low numbers only in mainstem habitats downstream of the Animas and San Juan confluence while razorback sucker is extremely rare and persists mainly as a few individuals that periodically enter the San Juan Arm of Lake Powell. If historically present, bonytail and humpback chub probably occurred mainly in the canyon-bound reaches of the lower San Juan River. Numerous human-induced modifications and manipulations of the aquatic habitats and introduction of non-native fishes have impacted all native fishes, including those that remain comparatively common.

The overall strategy of maintenance and enhancement of the native fish community must be accomplished to enable the achievement of the more specific goals of recovery and conservation of Colorado squawfish and razorback sucker. The successful accomplishment of this goal is dependent upon and will be assessed by the achievement of the following objectives. These general objectives provide the framework for development of interim management objectives and quantifiable recovery goals.

- 3.1.1. Mimickry of a natural hydrograph that reflects recent climatic (conditions to meet the biological and habitat needs of the fish while providing for human use of the water resources.
- 3.1.2. Management of extant native fish species and enhancement of depleted native species possible within the context of activities for endangered species.
- 3.1.3. Removal or remediation of factors which impede or preclude successful management of the native fish community.

3.2. RECOVERY AND CONSERVATION OF COLORADO SQUAWFISH IN THE SAN JUAN RIVER BASIN AS PART OF THE NATIVE FISH COMMUNITY.

3.2.1. REPRODUCTION

Spawning of sufficient frequency and magnitude must occur to produce adequate numbers of offspring for recruitment to the adult population. Conditions must be provided for annual reproduction. Reproduction will be documented by capture of young-of-year specimens.

3.2.2. RECRUITMENT

Regular recruitment of individuals to the reproductively active population is required for recovery and conservation.

3.2.3. RANGE AND ABUNDANCE

Range and abundance must be increased above current levels to secure occupation of designated critical habitat and other suitable areas.

3.2.4. RESTORE POPULATIONS

Improve habitat conditions to allow existing populations to respond to these habitat changes. If studies indicate remnant populations are too small or isolated to respond to habitat modifications then explore additional management options, including augmentation, to expand current wild populations.

3.3. RECOVERY AND CONSERVATION OF RAZORBACK SUCKER IN THE SAN JUAN RIVER AS A VIABLE PART OF THE NATIVE FISH COMMUNITY.

3.3.1. AVOID EXTIRPATION

Preclude further adverse modification of razorback sucker habitats and establish refugia.

3.3.2. RESTORE POPULATIONS

If studies indicate augmentation is feasible, stock razorback suckers of appropriate lineage to establish a viable population in San Juan River.

3.3.3. REPRODUCTION

Spawning of sufficient frequency and magnitude must occur to produce adequate numbers of offspring for recruitment to the adult population. Conditions must be provided for annual reproduction. Reproduction will be documented by capture of young-of-year specimens.

3.3.4. RECRUITMENT

Regular recruitment of individuals to the reproductively active population is required for recovery and conservation.

3.3.5. RANGE AND ABUNDANCE

Range and abundance must be increased above current levels to secure occupation of designated critical habitat and other suitable areas.

4.0. LONG RANGE PLAN OBJECTIVES

Achievement of the objectives of the Long Range Plan are dependent upon successful accomplishment of identified research and management activities. While the endangered fish species are the focus of these needs, the overall status and health of the entire native fish community must be the broader framework within which recovery and conservation is achieved. This section provides a description of these objectives and tasks, of both research and management orientation, required to attain recovery of the endangered fish species and management of the native fish community in the San Juan River basin. The sequence of objectives does not imply priority.

4.1. DEVELOP QUANTIFIABLE MEASURES OF ACHIEVEMENT OF RECOVERY OF NATIVE FISH COMMUNITY.

Assessment of the relative achievement of recovery and management objectives requires development of quantifiable measures of success (or failure). Relative measures to evaluate progress (Interim Management Objectives), using information obtained during the Seven Year Research effort, will be developed for Colorado squawfish, razorback sucker, and the native fish community. As new information is obtained these relative measures will be modified and quantifiable goals developed as necessary.

4.2. IDENTIFY, PROTECT, AND RESTORE HABITATS.

In order to determine full recovery potential of endangered fish species, qualification and quantification of the historic and present river channel conditions are necessary. Data on historic San Juan River channel conditions are available in varying and limited forms; however, sufficient data exist to allow limited comparisons with current channel conditions and dynamics. Initial tasks within this objective are to identify historic and current river channel conditions. This includes identification of geomorphically distinct river reaches and detailed habitat mapping of these reaches. Included within this characterization is a determination of overall changes from historic to current conditions. Research activities are designed to evaluate physical habitat changes, both qualitatively and quantitatively, as a response to different flow regimes. Activities are designed to address both unregulated flows and those that can be provided by releases from Navajo Dam. Modelling of flow and habitat relationships will be conducted to allow for a definition of expected river channel conditions that are likely to occur as a result of different flow regimes. Habitat use patterns by all life stages of endangered, other native, and non-native fish species will be determined and monitored to evaluate responses to different flow regimes. These data will be incorporated into flow recommendations. Results of native fish community habitat studies will be incorporated into management recommendations for the removal or modification of instream structures that impede native fish movements or limit range and creation or enhancement of required but unavailable or limited habitats. To identify and provide for flow regimes necessary to recover the endangered fish species and benefit the native fish community, an evaluation of the quality, quantity, and sources of water is required. While Navajo Reservoir has been identified as the primary origin, other sources, particularly the Animas River, will be investigated. Analyses of stream channel conditions provided by both reservoir-controlled flows and those occurring via inflow from tributary streams will be conducted. Included within the provision of flows necessary to recover the endangered fish species and manage the native fish community is the necessity to protect these flows. Means of protection will be attained through Tribal, State, and Federal regulatory actions.

4.3. IDENTIFY AND MANAGE THE NATIVE FISH COMMUNITY OF THE SAN JUAN RIVER BASIN TO RESTORE THE ENDANGERED FISH SPECIES

Protection and long-term management of the native fish community is best accomplished through an approach that emphasizes an evaluation of historic and current community structure dynamics. Specifically, identification of the spatial and temporal distribution and abundance patterns of the native fish species relative to man-caused alterations of the San Juan River is the focus of this objective. In concert with research activities on physical environmental changes, fish community data will provide necessary guidance for selection and implementation

of management activities.

Paramount to identifying the level of recovery possible for the endangered fish species is the characterization of the historic fish populations, including species diversity and abundance. To gain a better understanding of the changes from historic to current conditions, identification of the status and trends of native fish species is necessary. Specific research activities are designed to address the response of the current fish community to various flow regimes. Particular emphasis will be placed upon the response of the native and non-native fish species to various Navajo Reservoir releases. The life history of the endangered fish species will be determined within practical limits. Movement and habitat use patterns, reproductive habits, and young-of-year and juvenile distribution and occurrence will be emphasized. Efforts will be made to determine the response of the endangered fish species, including abundance and distribution, to flow regimes.

While efforts have been made to address fish health concerns in cultural and refugial environments, minimal attention has been given to determining fish health issues in wild populations. Studies of the San Juan River fish community have documented the widespread occurrence of external physical abnormalities. Initial results have indicated that bacterial infections, presumably due to environmental stresses, are adversely affecting fishes. Additional studies will be conducted to determine the identity, extent, and causes of fish health problems in the San Juan River.

Studies are underway to evaluate the genetic distinctiveness of San Juan River populations of Colorado squawfish and razorback sucker. These studies will be incorporated into any decision regarding the necessity for establishment of refugial populations or gene banks. If deemed necessary plans will be developed and implemented to protect the genetic resources of the endangered fish species. The need for an augmentation effort to restore or improve the status of endangered fish species will be determined and implemented. Currently, a captive-bred stock of razorback sucker from the San Juan River Arm of Lake Powell is maintained in a refugia. A portion of these fish are being used in field studies to delineate life history attributes of the species. These data will be used to determine the feasibility, utility, and type of augmentation necessary to assist in recovery of razorback sucker. Similar efforts for Colorado squawfish will be considered and evaluated, without interference with ongoing research activities on the species.

4.4. DETERMINE ROLES OF NON-NATIVE FISH SPECIES IN THE DECLINE OF NATIVE FISH SPECIES AND IMPLEMENT CORRECTIVE ACTIONS

In the Colorado River basin, non-native fish species have been implicated in the decline of the native fish fauna. Past and ongoing studies have indicated that habitat alteration and concurrent or subsequent introduction and establishment of non-native fish species result in depleted native fish populations or their

extirpation. Negative impacts of non-native fishes include predation and competition for limited resources (e.g., food and habitat). Studies to be accomplished under this objective will enable the identification and implementation of management actions to minimize or, if possible, eliminate adverse impacts of non-native fishes on native fishes.

As with the native fish community, it is necessary to characterize the distribution and abundance of non-native fish species. The identification of changes in the resident fish community with emphasis on the occurrence of non-native fishes can be related to other environmental changes for determination of cumulative effects.

Characterization of habitat use patterns of non-native fishes will determine the degree of overlap with native fish species habitat requirements. Fish communities in low velocity habitats are often numerically dominated by non-native species. Studies will be conducted to characterize interactions among native and non-native fishes in low-velocity habitats and to monitor responses of fish to flow mediated habitat availability.

While it is difficult to directly identify or quantify competitive interactions, the degree of commonality of food habits among native and non-native fishes can be characterized. Similarly, direct predative impacts may be identified through studies of food habits of non-native predators. Information from these studies will provide insights on the role of non-native species in the dynamics of the native fish community and need for measures to control non-natives.

The success in controlling non-native fish species will depend upon the variety and intensity of methods used. Flow manipulations to mimic the natural hydrograph and thereby diminish non-native fishes will not work alone. Management efforts must also include more intense regulation of the sport- and baitfish activities. Other methods, such as mechanical or piscicide removal may be implemented, if feasible.

4.5. DETERMINE THE OCCURRENCE, EXTENT, AND ROLE(S) OF WATER QUALITY DEGRADATION AND CONTAMINANTS IN THE DECLINE OF NATIVE FISH SPECIES AND IDENTIFY AND IMPLEMENT CORRECTIVE ACTIONS

The role of water quality degradation and contamination in the decline of native fish species of the Colorado River basin is not well understood. Preliminary research indicates that certain life stages of Colorado squawfish and razorback sucker are sensitive to elevated levels of several contaminants often found in the San Juan River. These results suggest additional studies to accurately characterize the effects of various water quality parameters (singly, synergistically, or antagonistically) are needed to improve management strategies for the endangered fish species. Studies and management activities outlined under this objective will address specific water quality impacts and necessary remedial actions.

Historical physical and chemical water quality of the San Juan River will be characterized using data from various sources, primarily that collected by the U.S. Geological Survey. Data gaps and informational needs regarding the type and source of water quality degradation and contamination will be emphasized.

Recent water quality studies have indicated that elevated levels of constituent elements and contaminants occur in the water and biota of the San Juan River. These pollutants are primarily related to agricultural, petrochemical/industrial, and municipal activities, but include a variety of other potential sources.

The biological effects of elevated constituent levels and contaminants on the endangered fish species will be determined by laboratory studies of hatchery-reared surrogates and, when possible, tissue analysis of wild specimens. Determination of the importance of the relative sensitivities of endangered fish species at different life stages will enable integration of this information with other factors which affect survival.

The comparative effects of unregulated Animas River and reservoir-controlled flows on selected physical-chemical water parameters in downstream reaches occupied by endangered and other native fish species will be evaluated. Water quality changes relative to hydrologic cycle and origin (i.e., mainstem San Juan River versus tributaries) will be qualified and quantified and related to known life history stage sensitivities. These data will assist in the selection of flow criteria designed to satisfy native fish requirements and to evaluate the efficacy of reservoir-controlled releases in providing needed environmental conditions.

4.6. DEVELOP AND IMPLEMENT AN INFORMATION AND EDUCATION PROGRAM TO INCREASE PUBLIC AWARENESS OF ENDANGERED FISH SPECIES AND THREATS TO HABITATS.

Without fail, every recovery planning document has identified the need for an increase in public awareness concerning resource protection, conservation (implying a certain degree of use), and, in some cases, preservation. The simple fact that intelligent use and management of natural resources, particularly those related to aquatic environments of the Southwestern United States, can accommodate maintenance of native fauna and flora and consumptive use (often ill-defined) is not well understood or perceived by the general public. This misunderstanding or misperception has been fostered by previous efforts to focus on the plight of a particular species or a small group of species rather than addressing the ecosystem that the species and, coincidentally, the general public depend upon. Thus, it is necessary to pursue appropriate public outreach programs that emphasize the similarity of needs of endangered species and the general public; both depend upon the same basic resource. That resource, simply put, is water; without that resource neither the endangered fish species nor the general public can exist in the San Juan River basin in perpetuity.

A variety of outreach tools will be employed to provide information to the public regarding the need and intent of the San Juan Recovery Implementation Program. These tools will include news releases, public meetings, presentations designed to provide information to the public and establish a forum for direct discussions, and program information dissemination. As appropriate, brochures, signs, and educational displays will be developed and used to educate the general and angling public about the reasons for and results of endangered species recovery.

4.7 DEVELOP, IMPLEMENT, AND MAINTAIN AN ADAPTIVE MANAGEMENT PROGRAM TO ENSURE CONDUCTING OF APPROPRIATE RESEARCH AND MANAGEMENT ACTIVITIES TO ATTAIN AND MAINTAIN RECOVERY OF ENDANGERED AND OTHER NATIVE FISH SPECIES.

A recovery program such as this for the San Juan River endangered fish species is only as effective as the method of self-evaluation and appropriate adjustment to meet the desired goal of recovery of the endangered fish species and management of the native fish community. It is necessary to continually analyze the influx of new or additional information regarding the biological, physical, and chemical conditions of the San Juan River basin. These conditions, coupled with socioeconomic realities of current and future water uses, will determine what, when, how, and why remedial methods will be employed to successfully implement recovery and management. It is therefore necessary to develop an adaptive management approach that allows timely incorporation of all available information to be used to evaluate the accuracy of such and adjust management actions as needed.

The LRP is based on adaptive management. It has been written to accommodate and encourage proactive measures to benefit the endangered fish species once such measures have been identified. The Seven Year Research Plan was designed primarily to conduct such research as was necessary to identify those actions and strategies that might contribute to the recovery of the endangered fish species. To force the process to identify specific recovery goals before basic research is complete would seriously compromise the integrity of any recommended actions. However, it is possible that measures to improve the status of the endangered fish species or their habitats will be identified before completion of the Seven Year Research effort. Testing of management recommendations is necessary before deciding on specific goals. Such testing will often require four or more years. Nevertheless, it is likely that some "recovery" measures may be implemented prior to 1997 or 1998. When it is appropriate, such measures will be recommended and evaluated.

A standardized and centralized database will be developed and maintained to ensure accurate compilation and storage of relevant biological data. This database will be made available to all resource agencies, institutions, and individuals conducting or evaluating research and management activities.

As research projects are completed or relevant findings verified, new information may identify additional research needs or identify immediate resource protection actions. Program management will allow for the conduct of new and approved research and implementation of necessary management actions.

A long-term monitoring program will be developed and implemented during this recovery program. Emphasis will be placed upon monitoring the status and trends of the resident fish community, geomorphology of the stream channel, flow/habitat relationships, changes in water quality, and hydrologic changes within the Basin.

As necessary, recovery actions and goals will be refined to reflect new information and the relative understanding of achievable management of the San Juan River fish community. Quantifiable recovery goals for Colorado squawfish and razorback sucker and management goals for the native fish community will be developed.

Peer review is essential to maintain the quality and integrity of all program activities. All study plans and completion reports will be reviewed at least by researchers on the Biology Committee and when practical by outside individuals knowledgeable of the topics addressed in individual reports. Researchers are encouraged to seek timely publication of research results in scientific journals and the Program will support such efforts.

5.0. LONG RANGE PLAN AND MILESTONES

A large variety of tasks have been identified as necessary to achieve the overall goals of the San Juan River Recovery Implementation Program. Achievement of specific milestones is typically dependent upon accomplishing several Tasks. Almost all Tasks contribute to the achievement of several milestones. The following sequence of objectives does not imply priority; rather, the sequence follows a logical progression in which basic research leads to more applied research and development of management strategies. Milestones in and of themselves do not constitute sufficient progress but may be used to help determine sufficient progress as specified in Section 4.2.1 of the San Juan River Recovery Implementation Program. Milestones are management decision points that allow evaluation of progress on the Program and provide direction for future actions. Sufficient progress will be determined by the U.S. Fish and Wildlife Service through the consultation process.

Progress towards goal achievement will include the following (not listed in priority and items are not necessarily of equal importance):

- ▶ Continuation of research to acquire data necessary to characterize and evaluate changes in biotic and abiotic conditions resulting from implementation of recommended recovery/management activities.
- ▶ Enhancement of habitats through flow manipulation, physical

alteration, water quality improvements, or other actions that positively contribute to recovery of the endangered fish species and management of the native fish community.

- ▶▶ Modification of current human activities which detrimentally impact or impair the quality of habitats.
- ▶▶ Acquisition of property or easements from willing and voluntary sellers for property which is identified as necessary for recovery.
- ▶ Quantifiable improvement in the status of native fish community, Colorado squawfish population, and razorback sucker population.

The above incorporates items listed in Section 4.2.1 of the San Juan River Recovery Implementation Program.

There is a considerable body of published and unpublished literature on western North American fishes (native and non-native), their biology, habitats, and ecological relationships. This information will be used, as appropriate, in planning, conducting research, interpreting research/management results, and recommending research and management activities.

The elements of the Seven Year Research Plan are incorporated in the LRP. Completion of these elements will allow improved quantification and prioritization of milestones and actions necessary to achieve the ultimate goal of recovery and conservation of the endangered fish species and management of the native fish community of the San Juan River basin.

The Tasks detailed in 5.1 through 5.7 are required to accomplish the objectives necessary for recovery of the San Juan River endangered fish species. Tasks are not listed in order of priority; rather, order of listing reflects the appropriate scheduling for successful and efficient accomplishment of objectives. In nearly all phases of the research program that is to be completed in 1997, tasks are concurrent with one another. Table 1 displays the integration of tasks required for development and implementation of management decisions as support for the listed milestones. Figure 1 graphically presents the timeline of task completion and portrays the concurrent nature of the tasks. Task completions that represent milestones are displayed as such.

Budgets outlining expenditures for research and management actions to accomplish recovery tasks will be approved on an annual basis by the Coordination Committee per Section 6.5 of the San Juan River Recovery Implementation Program.

5.1 DEVELOP INTERIM MANAGEMENT OBJECTIVES FOR THE ENDANGERED FISH SPECIES AND NATIVE FISH COMMUNITY OF THE SAN JUAN RIVER

- 5.1.1. Colorado squawfish population goal (Milestone).
- 5.1.2. Razorback sucker population goal (Milestone).
- 5.1.3 . Other native fishes population goal (diversity, abundance, distribution).
- 5.1.4 . Evaluate, integrate, and report research findings annually and make recommendations based upon these findings.

5.2 IDENTIFY, PROTECT, AND RESTORE HABITATS WITHIN THE SAN JUAN RIVER BASIN NECESSARY FOR RECOVERY OF THE ENDANGERED FISH SPECIES AND MANAGEMENT OF THE NATIVE FISH COMMUNITY

- 5.2.1. Characterize historic and current stream channel geomorphology and associated riparian zones.
 - 5.2.1.1 Determine geomorphically distinct reaches.
 - 5.2.1.2 Characterize habitat for each of the reaches.
- 5.2.2 . Determine changes in channel morphology from historic conditions and with changes in flow regime.
- 5.2.3 . Quantify and compare/contrast available aquatic habitats as a response(s) to natural and manipulated flows.
 - 5.2.3.1 Monitor the fate of habitat availability as a result of different flows.
- 5.2.4 . Model flow and habitat relationships.
- 5.2.5 . Determine and monitor habitat use of endangered and other native fishes.
 - 5.2.5.1 Determine habitat requirements for different life stages.
 - 5.2.5.2 Identify subreaches that provide habitats for the different life stages.
- 5.2.6 . Identify limiting habitats (Milestone)
- 5.2.7 . Identify, recommend, and implement flows designed to maximize and maintain suitable habitats for all life stages of

endangered and other native fish species (Milestone).

5.2.7.1 Identify and recommend flows.

5.2.7.2 Provide recommended flows.

5.2.8. Obtain legal protection for flows identified to recover endangered fish species (Milestone).

5.2.9 . Determine the need for and, if necessary, implement actions designed to accomplish non-flow physical habitat modification for endangered fish species.

5.2.9.1 Identify (Milestone)

5.2.9.2 Implement (Milestone)

5.2.9.2.1 Removal/alteration of instream barriers to fish movement.

5.2.9.2.2 Creation of required but unavailable habitats.

5.2.9.3.3 Modification to Navajo Dam outlet works.

5.2.10 Long term monitoring

5.3 IDENTIFY, PROTECT, AND RESTORE THE ENDANGERED FISH SPECIES OF THE SAN JUAN RIVER BASIN AND MANAGE THE NATIVE FISH COMMUNITY

5.3.1. Identify and characterize the historic and current fish species community structure.

5.3.2 . Determine the status and trends of the resident fish species.

5.3.3 . Determine the life history of endangered and other native fish species and relationships to all other resident fish species.

5.3.4 . Identify fish health aspects that negatively impact native fish species.

5.3.5 . Characterize fish species community response to different annual flow regimes.

- 5.3.6 . Identify limiting factors for the endangered and other native fishes (Milestone).
- 5.3.7 . Develop and implement a genetics management plan to maintain genetic diversity of the endangered fish species (Milestone).
 - 5.3.7.1 Collect tissues and characterize genetic makeup of endangered fish species (Milestone).
 - 5.3.7.2 Establish refugia populations of endangered fish species if warranted (Milestone).
 - 5.3.7.2.1 Cryogenic preservation of gametes.
- 5.3.8 . Determine the need for and implement, if necessary, an augmentation program to recover endangered fish species in appropriate historic habitat.
 - 5.3.8.1 Evaluate reproduction and recruitment potential.
 - 5.3.8.2 Develop augmentation plans for endangered fish species (Milestone).
 - 5.3.8.3 Develop hatchery broodstocks of endangered fish species of San Juan River origin.
- 5.3.9 . Long term monitoring program

5.4 DETERMINE THE ROLE(S) OF NON-NATIVE FISH SPECIES IN THE DECLINE OF NATIVE FISH SPECIES AND IMPLEMENT CORRECTIVE ACTIONS

- 5.4.1. Characterize distribution and abundance of non-native fish species.
- 5.4.2. Identify and characterize habitats used by non-native fish species and effects on native fish species habitat use.
- 5.4.3 . Describe food habits of non-native fish species and evaluate for predation and competition impacts on native fish species (Milestone).
- 5.4.4 . Characterize the response of non-native fish species to varying flow regimes and recommend flows that minimize or eliminate interactions with native fish species.

- 5.4.5 . Develop a non-native fish stocking policy (Milestone).
- 5.4.6. Develop and implement regulations to restrict baitfish species harvest within appropriate habitats (Milestone).
- 5.4.7. Develop and implement regulations to restrict import of non-native fish species (Milestone).
- 5.4.8 . Monitor and evaluate actions implemented to minimize or eliminate native and non-native fish species interactions.

5.5 DETERMINE THE OCCURRENCE, EXTENT, AND ROLE(S) OF WATER QUALITY DEGRADATION AND CONTAMINANTS IN THE DECLINE OF THE ENDANGERED FISH SPECIES AND IDENTIFY AND IMPLEMENT CORRECTIVE ACTIONS

- 5.5.1 . Identify and characterize historic water quality conditions of the Basin.
- 5.5.2 . Identify and characterize the presence and extent of contaminants and their sources (Milestone).
- 5.5.3 . Identify and quantify biological effects of contaminants on endangered and other native fishes (Milestone).
- 5.5.4. Identify changes in water quality and compare to the hydrologic cycle by river reach and tributary.
- 5.5.5. Recommend allowable contaminant levels (Milestone).
- 5.5.6 . Identify and implement corrective actions to improve water quality and to minimize or eliminate contaminant sources necessary for recovery of the endangered fish species (Milestone).
- 5.5.7 . Develop and maintain a database for all relevant water quality and contaminants data.
- 5.5.8 . Develop and implement a monitoring program to evaluate efficacy of corrective actions.

5.6 IMPLEMENT AN INFORMATION AND EDUCATION PROGRAM TO INCREASE PUBLIC AWARENESS ABOUT ENDANGERED FISH SPECIES AND THREATS TO THEIR HABITATS

- 5.6.1. Produce news releases and conduct public meetings and presentations.
- 5.6.2. Develop brochures, signs, and educational displays to educate the general and angling public about endangered fish species.
- 5.7 **IMPLEMENT AND MAINTAIN AN ADAPTIVE MANAGEMENT PROGRAM TO ENSURE CONDUCT OF APPROPRIATE RESEARCH AND MANAGEMENT ACTIVITIES TO ATTAIN AND MAINTAIN RECOVERY OF ENDANGERED FISH SPECIES. THE BIOLOGY COMMITTEE WILL MEET AS FREQUENTLY AS NECESSARY, BUT AT LEAST ANNUALLY, TO EVALUATE RESEARCH ACTIVITIES, MANAGEMENT ACTIONS, AND RECOVERY STRATEGIES TO REFINE AND IMPROVE THE PROGRAM FOR THE ENDANGERED FISH SPECIES OF THE SAN JUAN RIVER BASIN**
- 5.7.1. Develop and implement a long-term standardized monitoring program to identify changes in the endangered and other native fish species populations, status, distributions, and habitat conditions (Milestone).
- 5.7.2. Develop and maintain a standardized database for storage and retrieval of biotic and abiotic data.
- 5.7.3 . Review and revise research activities to further define needs of and threats to endangered and other native fish species.
- 5.7.4 . Evaluate and refine recovery actions, as necessary, to accomplish recovery goals.
- 5.7.5 . Develop and refine quantifiable recovery goals.

Table 1. Outline and Schedule of Task Accomplishment and Milestone Achievement.

	Objectives	Milestone	Date		Tasks	Date
	5.1.1	Interim population goal for Colorado squawfish	1997		5.2.5	1996
					5.3.1	1995
					5.3.2	1997
					5.3.3	1995 etseq
					5.3.4	1996
					5.3.5	1995 etseq
					5.3.7 (Milestone)	1996
					5.3.8	1996
					5.4.3 (Milestone)	1996
					5.4.4 (Milestone)	1997
					5.7.3 (Milestone)	1994 etseq
	5.1.2	Interim population goal for Razorback sucker	1997		5.2.5	1996
					5.3.1	1995
					5.3.2	1997
					5.3.3	1997
					5.3.4	1996
					5.3.5	1995 etseq
					5.3.7 (Milestone)	1996
					5.3.8	1996
					5.4.3 (Milestone)	1996
					5.4.4 (Milestone)	1997
					5.7.3 (Milestone)	1994 etseq

Table 1. (continued)

	Objectives	Milestone	Date		Tasks	Date
	5.1.3	Interim population goal (diversity, abundance, trends distribution) for other native fishes	1997		5.2.5	1996
					5.3.1	1995
					5.3.2	1997
					5.3.3	1995 etseq
					5.3.4	1996
					5.3.5	1997
					5.3.8	1996
					5.4.3 (Milestone)	1996
					5.4.4	1997
					5.5.3	1996
					5.7.3	1994 et seq
	5.2	Identify limiting habitats	1996		5.2.3	1996
					5.2.5	1996
					5.3.3	1995 etseq
					5.3.5	1995 etseq
					5.4.2	1996
					5.4.4 (Milestone)	1997
					5.5.4	1996
					5.7.3 (Milestone)	1995 etseq
	5.2., 5.4	Flow recommendations	1997		5.2.3	1996
					5.2.4	1996
					5.2.5	1996

Table 1. (continued)

	Objectives	Milestone	Date		Tasks	Date
					5.2.6	1996
					5.2.7.1 (Milestone)	1997
					5.2.9 (Milestone)	1997
					5.3.5	1997
					5.4.4 (Milestone)	1997
	5.2	Implementation and protection of recommended flows	1998		5.2.7.2 (Milestone)	1998
					5.2.10 (Milestone)	1998
					5.4.4	1997
	5.2	Identify non-flow needed habitat modifications	1997		5.2.6	1996
					5.2.8.1 (Milestone)	1997
	5.2	Implement needed habitat modifications	1998		5.2.6	1996
					5.2.8.1 (Milestone)	1997
					5.2.8.2 (Milestone)	1998
	5.3	Identify factors limiting Colorado squawfish life stages	1997		5.1.1	1997
					5.2.6	1996
					5.3.6	1997
					5.5.3	
	5.3	Identify factors limiting Razorback sucker life stages	1997		5.1.2	1997
					5.2.6	1996
					5.3.6	1997
					5.5.3	

Table 1. (continued)

	Objectives	Milestone	Date		Tasks	Date
	5.3	Identify factors limiting other native fish species'	1997		5.1.3	1997
					5.2.6	1996
					5.3.6	1997
					5.5.3	
	5.3	Genetics Management Plan for Colorado squawfish	1996		5.3.7 (Milestone)	1996
					5.3.7.1	1995
	5.3	Establish refugia for Colorado squawfish, if necessary	> 1997		5.3.7.2 (Milestone)	> 1997
	5.3	Develop a genetics Management Plan for Razorback sucker	1996		5.3.7 (Milestone)	1996
					5.3.7.1	1994
	5.3	Establish refugia for Razorback sucker if necessary	1996		5.3.7.2 (Milestone)	1996
	5.3	Determine the need for augmentation of Colorado squawfish	1997		5.1.1	1997
					5.3.6	1997
					5.3.8.1	1997
					5.3.8.2	1997
	5.3	Augment the Colorado squawfish population if necessary			5.3.8 (Milestone)	
					5.3.8.2	
					5.3.8.3	
	5.3	Determine the feasibility of augmentation of Razorback sucker	1996		5.1.1	1996
					5.3.6	1996
					5.3.8.1	1996

Table 1. (continued)

	Objectives	Milestone	Date		Tasks	Date
					5.3.8.2	1996
	5.3	Augment Razorback sucker if feasible	1997		5.3.8.2 (Milestone)	1997
					5.3.8.3	1997
	5.4	Determine negative interactions of non-native fish species to facilitate control	1997		5.3.1	1995
					5.3.2	1997
					5.3.3	1997
					5.3.4	1996
					5.3.5	1997
					5.3.6	1997
					5.4.1	1997
					5.4.2	1996
					5.4.3	1997
					5.4.4	1997
	5.4	Develop and implement a non-native fish stocking policy	1995		5.4.5 (Milestone)	1995
	5.4	Restrict baitfish harvest	1995		5.4.6 (Milestone)	1995
	5.4.7	Restrict import of non-native fish	1995		5.4.7 (Milestone)	1995
	5.5.2	Identify contaminant sources	1997		5.5.2 (Milestone)	1997
					5.5.4	1996
	5.5.3	Quantify biological effects of contaminants	1996		5.5.3 (Milestone)	1996
	5.5.5	Recommend allowable contaminant levels	1997		5.5.3 (Milestone)	1997
					5.5.4	1996
					5.5.5	1997

Table 1. (continued)

	Objectives	Milestone	Date		Tasks	Date
	5.5.7	Identify and implement remediation actions for contaminants sources	1997 etseq		5.5.2	1997 etseq
					5.5.5	1997
					5.5.6 (Milestone)	1995
	5.6	Develop public information plan	1995		5.6 (Milestone)	1995
	5.7	Develop and implement long-term standardized monitoring program	1998		5.2.1.1	1993
					5.3.9	1998
					5.4.8	1998
					5.5.8	1998
					5.7.1 (Milestone)	1998
	5.7	Develop and maintain standardized database	1992 etseq		5.5.7	1994
					5.7.2 (Milestone)	1992 etseq
	5.7	Identify additional research necessary	1991 etseq		5.7.1	1998
					5.7.3 (Milestone)	1997 etseq
	5.7	Evaluate and refine recovery efforts	1998 etseq		5.2.7	1997
					5.2.8	1998
					5.2.9	1998
					5.3.7	1996
					5.3.8	1996
					5.4.8	1998
					5.5.6	1998
					5.6	1995
					5.7.4 (Milestone)	1998 etseq

Table 1. (continued)

	Objectives	Milestone	Date		Tasks	Date
	5.7.5	Develop quantifiable recovery goal for Colorado squawfish	2002		5.1.1	2002
					5.7.4 (Milestone)	2002
	5.7.5	Develop quantifiable recovery goal for Razorback sucker	2002		5.1.2	2002
					5.7.4 (Milestone)	2002
	5.7.5	Develop quantifiable recovery goals for the native fish	2002		5.1.3	2002
					5.7.4 (Milestone)	2002

Figure 1. Timeline for major tasks and milestones

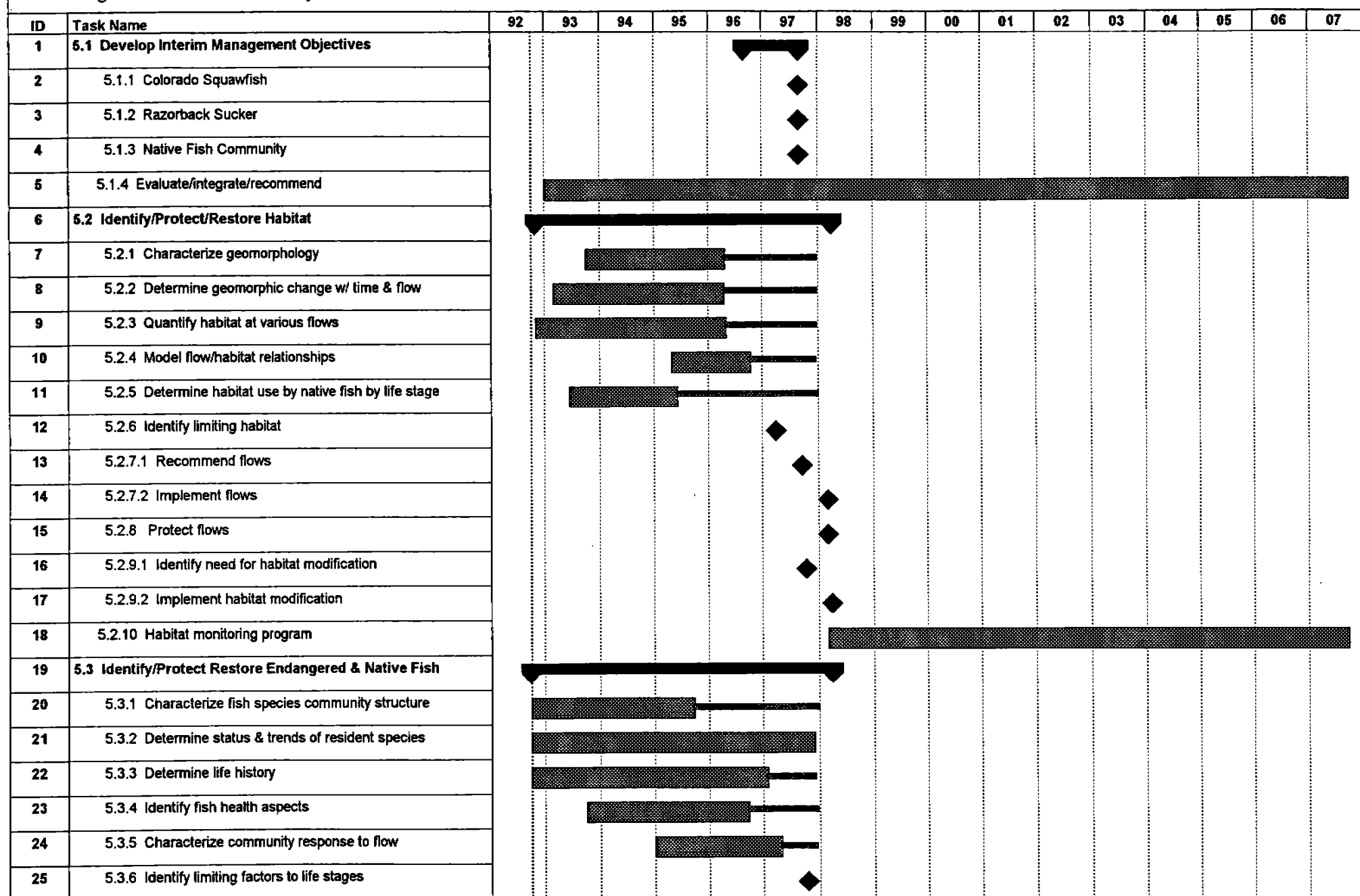


Figure 1. Timeline for major tasks and milestones

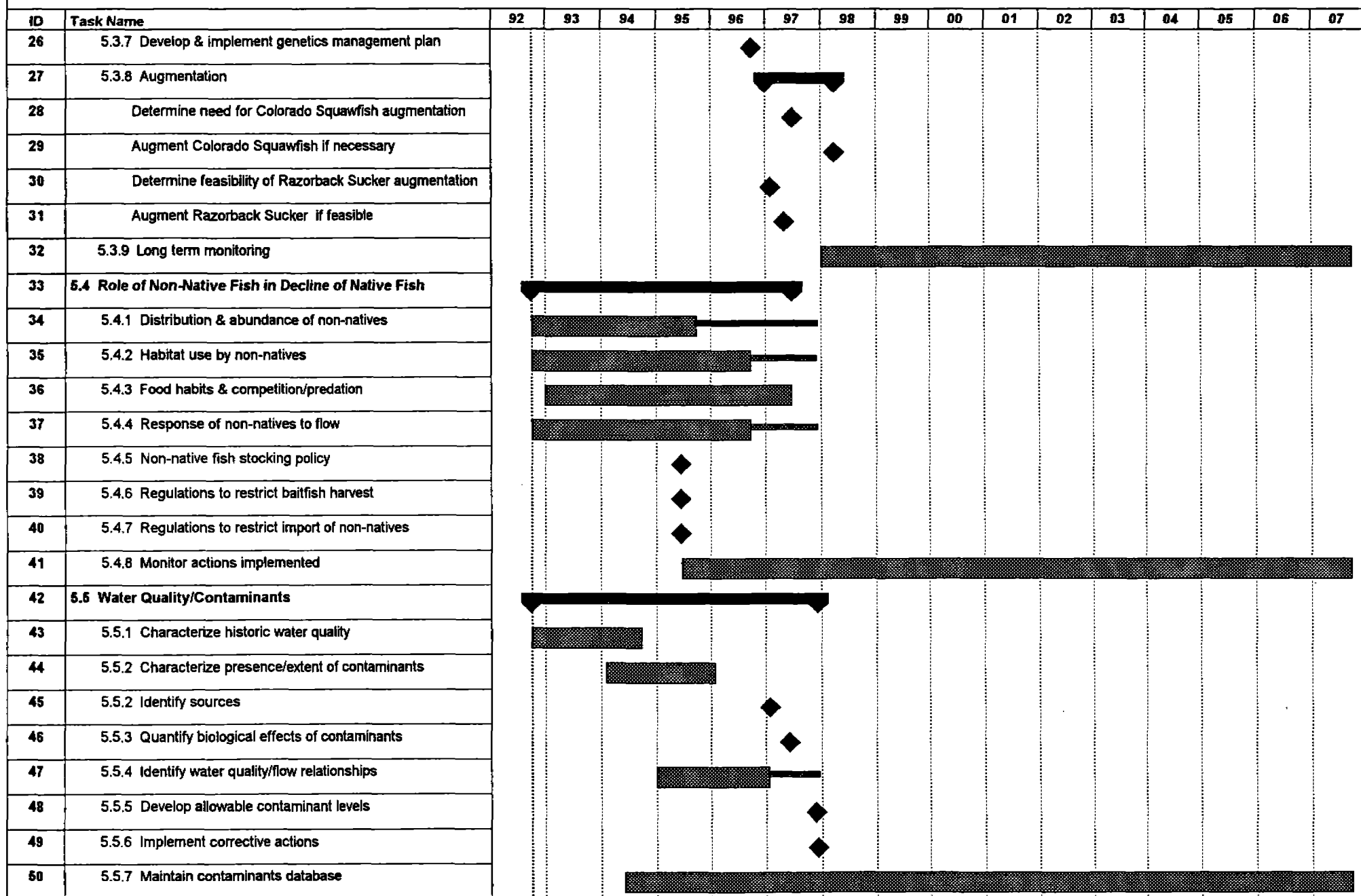
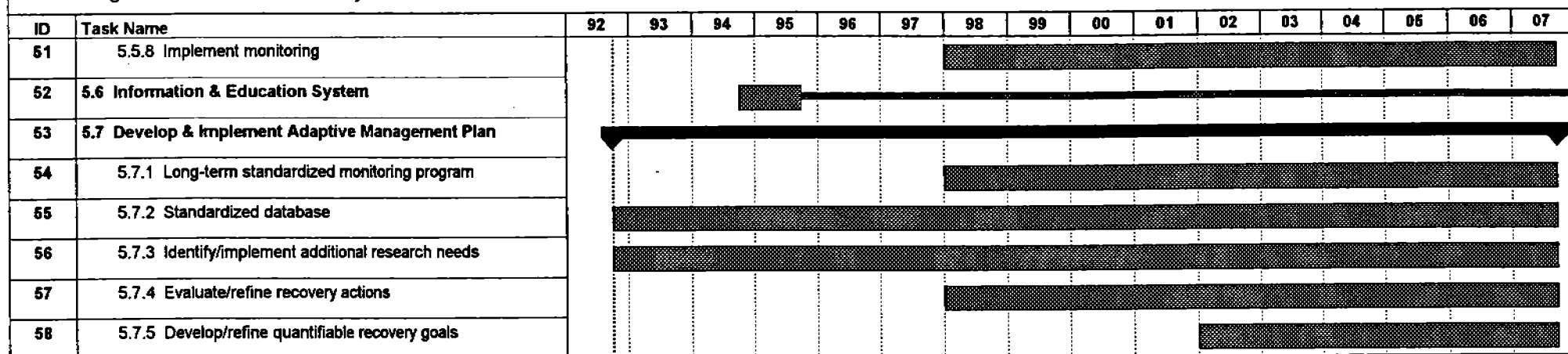





Figure 1. Timeline for major tasks and milestones



Task		Summary	
Milestone		Reduced Level	